

R&D FACILITY facts

DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
FEDERAL ENERGY TECHNOLOGY CENTER

GAS STREAM cleanup PROJECT

COLD-FLOW CIRCULATING FLUID-BED UNIT

Capabilities

CONTACT POINTS

TECHNICAL:

Joseph S. Mei**

Mechanical Engineer

Office: (304) 285-4409

E-Mail: jmei@fetc.doe.gov

ADMINISTRATIVE:

R. Diane Manilla**

Technology Transfer
Program Manager

Office: (304) 285-4086

E-Mail: rmanil@fetc.doe.gov

David Wildman*

Senior Management
Technical Advisor

Office: (412) 892-4913

E-Mail: wildman@fetc.doe.gov

MAIL ADDRESS:

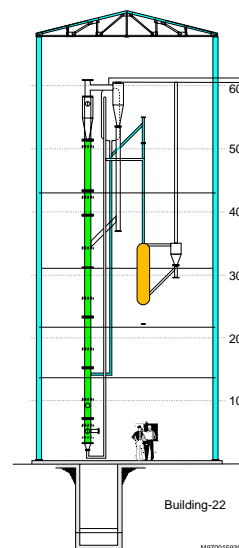
* U.S. Department of Energy
P.O. Box 10940
626 Cochran's Mill Road
Pittsburgh, PA 15236-0940

** U.S. Department of Energy
P.O. Box 880
3610 Collins Ferry Rd.
Morgantown, WV 26507-0880

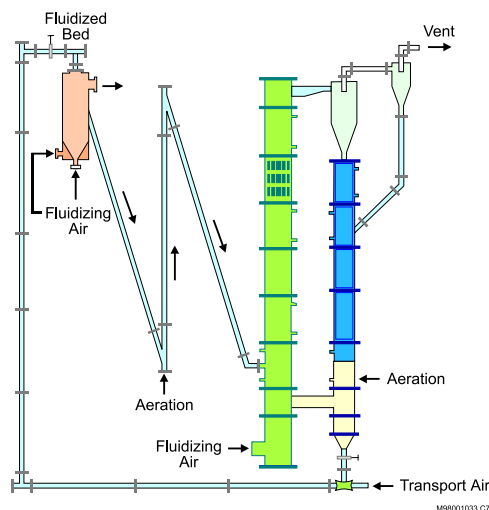
A cold model operated at FETC is a flexible and versatile facility. Optimization of novel coal fluidized-bed reactors require that we solve a variety of solid transfer issues. These issues are encountered in both integrated gasification combined-cycle (IGCC) and advanced pressurized fluidized-bed combustion (APFBC) power trains. Tools are needed to visualize solids flow systems and explore possible solutions to problems. The project team's objective is to provide support to circulating fluid-bed (CFB) systems through analysis of existing plants, optimization of plant operations, and evaluation of new designs.

The cold-flow unit is capable of simulating fully integrated operations for solids transfer and control systems as is common to many advanced coal-fired power systems. Currently, DOE is providing financial support for operations or design and construction of six CFB process plants.

The cold-flow unit consists of a riser, a two-stage cyclone, and a standpipe, and will shortly include a 2-ft diameter fluidized bed (FB) with an associated cyclone and make-up hopper. Transport lines will connect these vessels in a variety of configurations with mechanical and non-mechanical solids control valves. The main riser is 1 ft diameter, 56 ft high, and consists of metal and acrylic spool pieces. The facility will have a supply of 250,000 scfh air with the ability to obtain superficial velocities of 10 to 30 ft/s in the riser, and 0.2 to 0.7 ft/s in the FB. The operating pressures will range from 0 to 15 psig at the riser outlet and up to 30 psig in the FB.



Elevation drawing
of cold flow unit

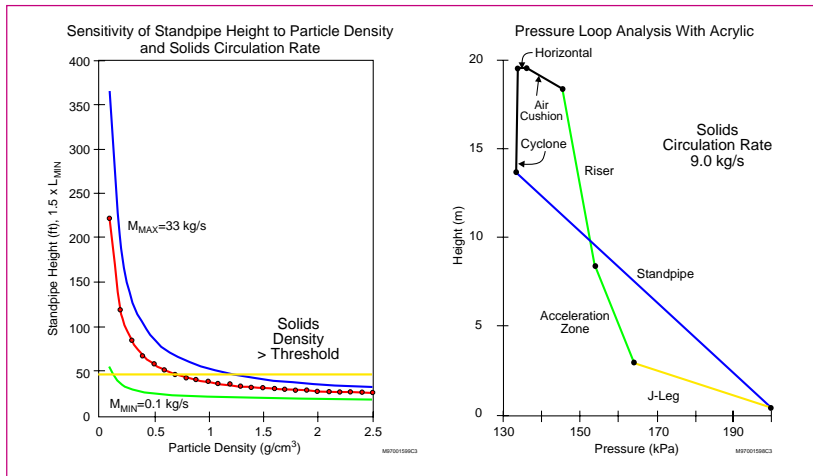


Simplified process flow diagram for the
cold flow circulating fluid-bed test facility

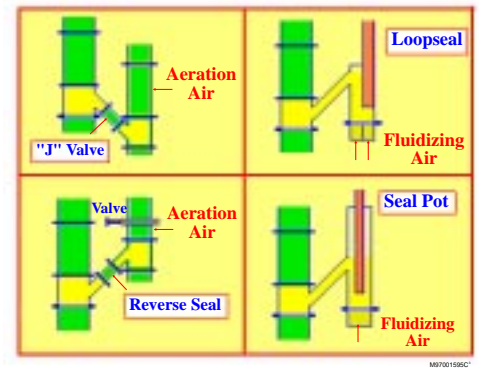
Screening tests with both acrylic and polyvinyl chloride particles have been conducted using a 45-angle inclined J-valve. The CFB operating regime was mapped using a composite test matrix of 30 setpoints to allow statistical evaluation of process variations. Experimental data on solids circulation was collected using 4 independent measurement techniques: visual particle tracking, rotation of an internal spiral mechanism, cross correlation of two high-speed pressure differential sensors in series axially along the riser, and a laser optical sensing device developed at FETC. Construction of the FB unit and associated transfer lines should be completed by the end of 1998.



COLD-FLOW CIRCULATING FLUID-BED UNIT



Pressure profiles and operating conditions achievable in the cold flow test facility
















Non-mechanical valve configurations to be tested

Opportunities

The cold-flow circulating fluid-bed unit provides the following opportunities:

- A **user's test facility** for private industry to test specific component designs and configurations.
- Better understanding of operational principles of gas-solid transfer and control among reactor vessels.
- Data to verify the mathematical models; use these data to develop stochastic and engineering models.
- Design and scale-up data of gas-solid transfer devices.
- A platform to develop and test instrumentation and novel non-mechanical valves, down-comers, and other devices.
- A training simulator for plant operating personnel.

ID	TASK NAME	1998										1999			
		APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	
1	J-Valve Tests														
4	Instrumentation														
9	Solids Velocity Probe														
5	Mass Circulation Rates														
12	Solids Density														
15	L-Valve Tests														
26	NOx SO TestsTest														
18	Control Strategies														
28	Phase II Construction FW Design														
22	MW Kellogg CRADA														
37	Shakedown Phase II														
40	Operation N-Valve														

Schedule for design, construction, and operation of the cold flow CFB test facility

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